

ZELTEX, INC.

SOLID STATE OPERATIONAL AMPLIFIERS • CONDENSED CATALOG

Effective August 1965



NEW ZELTEX FACILITY SCHEDULED FOR COMPLETION ON
OCTOBER 1, 1965



in just a few long years...

Founded in 1962, Zeltex began producing high performance amplifiers for the computer and instrumentation fields. During these years, years comprised of long days and long weeks, Zeltex has become a major manufacturer of high quality solid state devices.

Zeltex believed that people are essential to success in a swiftly changing technology. From the outset, key personnel in research, manufacturing and administration organized to develop what is now the industry's broadest line of operational amplifiers and analog computer elements.

Some significant Zeltex firsts include: the first chopper stabilized differential amplifiers employing transistors rather than vacuum tubes, the first 100 volt solid state differential amplifier, and the first production differential operational amplifier to use field effect transistors for high input impedance and low input current. At Zeltex, competitive pricing is recognized to be as important as reliability and technical sophistication; the Model 140B is the industry's first 100 volt solid state amplifier to be available at vacuum tube prices.

Also in the comprehensive Zeltex line are: low cost differential amplifiers, an entire family of sophisticated chopper stabilized differentials, a variety of single ended stabilized amplifiers, and a series designed especially for application in analog computers and flight simulators.

and tomorrow?

Today, a host of new and exciting devices is emerging from the laboratory ready for industrial use. ☐ Zeltex management is fully committed to the philosophy that continued research in product design and application is fundamental to manufacturing the finest and most sophisticated solid state amplifiers. The standard amplifiers shown in this brochure are continually being improved and augmented with new designs. ☐ The experience of the Zeltex engineering and management team rests in analog computer technology. The operational amplifiers presented here represent the initial step in a program of planned product expansion. Product expansion in computer elements and special purpose computer systems will be accelerated in the immediate future. We invite you to keep abreast with the new Zeltex developments by completing and returning the enclosed self-addressed reply card.

Reliability must be built into the product at every step...

Quality has continued to be a prime consideration in Zeltex designs and production methods. To reflect true reliability in the end product, it is essential to stress quality in engineering and production and then to thoroughly check the product in final test.

Zeltex engineering is continually investigating new components and design techniques. The decision of whether or not to use a new exotic component is often tempered by an awareness of the strict reliability requirements born from experience with basic component failure rates under extensive environmental testing.

All phases of manufacturing are under the close scrutiny of the Zeltex Quality Control Program. Highest reliability components are used wherever possible. All circuitry is hand soldered on MIL grade glass-epoxy etched circuit cards. Most components are of the MIL type. Where new devices have not yet been MIL approved, they are accepted only where the manufacturer can supply certification that construction is in compliance with MIL requirements.

Testing is in full compliance with MIL-Q-9858 whether the amplifiers are destined for military use or not. All amplifiers are baked and aged before final test. Every amplifier is fully tested under temperature prior to shipment. A complete test record is kept on file at the factory for each amplifier, and a copy is included with the amplifier at time of shipment. Government or company source inspection is welcomed where desired.

a word about specials...

The amplifiers shown on the next four pages are standard Zeltex designs which are continually manufactured in regularly scheduled production lots. In addition to the standard units, Zeltex has engineered and produced over 100 different types for special applications. Most of these were created by the "specials team" who were organized for quick reaction to custom requirements. If you need a modification of a standard design or a special design, contact the Zeltex Sales Department; perhaps your amplifier has been partially or completely designed for one of our other customers.

Most of these custom designs fall into the more popular categories listed below.

1. Increased output range of current or voltage.
2. Modification for different power supply levels.
3. Altered card size, connector type or packaging configuration.
4. Electrical design and packaging to MIL specifications (including shipboard, airborne or fire control specs and environments).
5. Increased high frequency gain with tailored marginal stability.
6. Exceptionally fast slew rate and settling time for conversion systems.

In addition, Zeltex design and applications engineers are particularly experienced in these two areas:

1. Amplifier applications; synthesis of custom transfer functions, active filtering, voltage to current conversion, special function generation, sample hold circuitry and other fast switching applications.
2. Analog systems; special purpose analog computers and simulators, digital and iterative control of analog systems, solid state computing elements for special or general purpose analog computers.

Comprehensive environmental tests over temperature range comply with MIL-Q-5898.



On-line inspection is performed for each step.



All amplifiers are aged for 100 hours for drift stabilization.



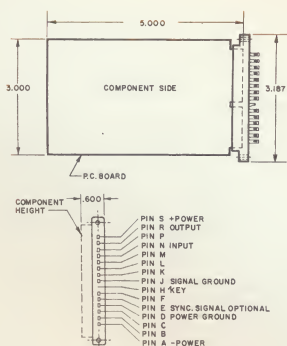
SINGLE ENDED AMPLIFIERS

a word about the ZELTEX single ended amplifiers...

The amplifiers tabulated below are all single input, single output (inverting) types. All versions use silicon semiconductors exclusively and employ FET choppers. All units are short circuit protected. In all cases, wideband noise is

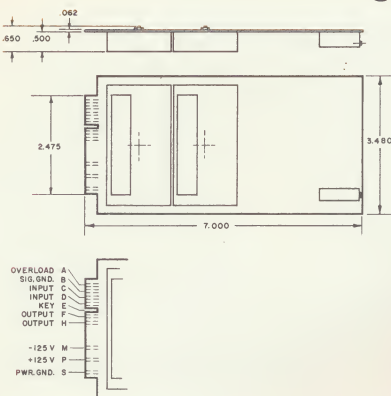
measured with the amplifier connected as a unity inverter to reflect the true noise level over the full bandwidth. Mating connectors are supplied with all amplifiers at no increase in cost.

CHARACTERISTICS (@ 25° C unless noted)	1. SUPPLY VOLTAGE 2. QUIESCENT CURRENT 3. OUTPUT VOLTAGE 4. OUTPUT CURRENT 5. GAIN AT D.C. 6. INPUT IMPEDANCE (at D.C.) 7. OFFSET VOLTAGE ADJUSTMENT 8. INPUT VOLTAGE DRIFT vs TEMP. 9. INPUT VOLTAGE DRIFT vs TIME (Constant Temp.) 10. INPUT CURRENT 11. INPUT CURRENT DRIFT vs TEMP. 12. INPUT NOISE, NARROW BAND (2 cps to 20 cps) 13. INPUT NOISE, WIDE BAND (2 cps to 1 mc) 14. GAIN BANDWIDTH PROD (at unity gain)														
	UNITS	± volts	ma	± volts	ma	v/v	meg	—	μv/°C	μv/8 hr	pa	pa/°C	μv, pk	mv, pk	mc
MODEL															
140		24	15	20 / 10	4 / 20	10 ⁷	0.5	INT	3	35	50	5	100	5	0.2
140M15		15	15	10	20	10 ⁷	0.5	INT	3	35	50	5	100	5	0.2
140A		24	15	20 / 5	4 / 100	10 ⁷	0.5	INT	3	35	50	5	100	5	0.2
140B		125	20	100 / 60	20 / 30	10 ⁷	0.5	INT	3	25	30	5	100	0.5	1
141		24	15	20 / 10	4 / 20	5 x 10 ⁷	1	INT	1	10	10	1	40	0.5	1
142		125	25	100	20	5 x 10 ⁷	1	INT	1	10	10	1	40	0.5	1
143		75	25	50	25	5 x 10 ⁷	1	INT	1	10	10	1	40	0.5	1
141C		24	15	20 / 10	4 / 20	5 x 10 ⁷	1	INT	1	10	10	1	50	0.5	1
142C		125	25	100	20	5 x 10 ⁷	1	INT	1	10	10	1	50	0.5	1
143C		75	25	50	25	5 x 10 ⁷	1	INT	1	10	10	1	50	0.5	1



CASE STYLE A

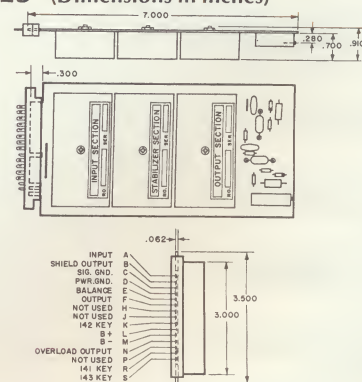
(Mating connector supplied:
Viking VK15S/1-2 or equivalent.)



CASE STYLE B

(Mating connector supplied:
Viking VK15S/1-2 or equivalent.)

CASE SIZES (Dimensions in inches)



CASE STYLE C

(Mating connector supplied:
Viking VK15S/1-2 or equivalent.)

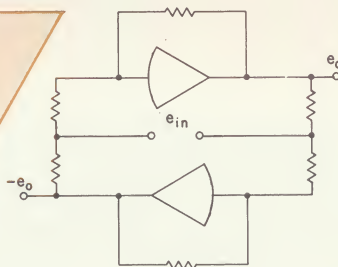


Model 140B

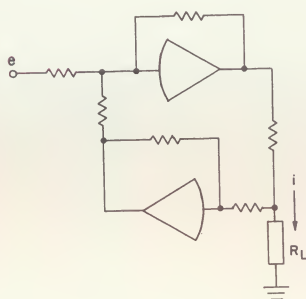
applications

Single ended amplifiers usually employ chopper stabilization for drift correction which results in excellent voltage and current drift and especially fine low frequency performance. Only a few of the more interesting applications are shown below. Now that high speed semiconductor current switches are available and inexpensive, a whole new variety of applications can be performed with fast operational amplifiers.

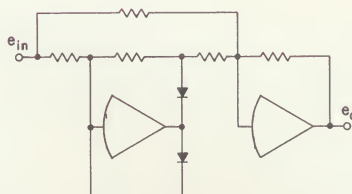
15. FREQUENCY FOR FULL OUTPUT	16. SLEW RATE	17. TEMPERATURE RANGE, Operating	18. CASE TYPE	19. PRICES (1-9)	20. PRICES (10-24)
Kc	v/μsec	°C		\$	\$
100	12	0 to 60	A	90	84
100	6	0 to 60	A	90	84
		0 to 60	A	118	112
20	12	0 to 60	B	135	130
125	15	0 to 60	C	170	167
25	15	0 to 60	C	185	181
25	7	0 to 60	C	195	191
125	15	-25 to +85	D	190	185
25	15	-25 to +85	D	220	215
25	7	-25 to +85	D	230	225



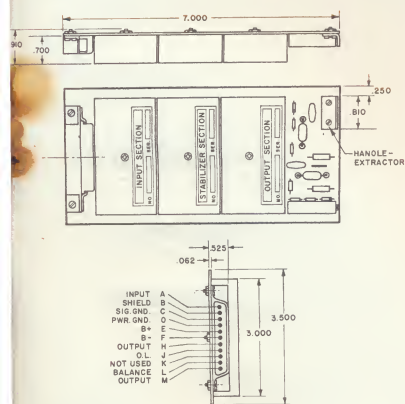
Differential input, differential output circuit. Design closed loop gain at unity. Very useful high input impedance results from 'bootstrapped' input terminals.



Voltage to current conversion. Current delivered to load is controlled by input signal. With loop gain set precisely at unity, effective output impedance becomes bootstrapped to infinity. ma/volt scaling accomplished by changing input resistor to maintain unity loop gain.



Absolute value circuit. Uses precision rectifier and summer for single polarity output and equal gain for both polarity input signals. Negative signal gain can be different from positive input signal gain.

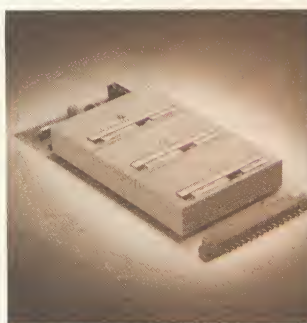


CASE STYLE D

(Ruggedized for MIL environments.

Mating connector supplied:

Winchester NAS714-11 or equivalent.)



Models 141/142



Model 140

DIFFERENTIAL AMPLIFIERS

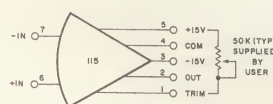
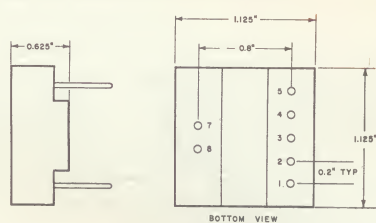
a word about the ZELTEX differentials...

The differential operational amplifiers tabulated below are of two types: (1) small encapsulated modules which employ matched input stages (either regular transistors or FET's) for drift cancellation, and (2) the larger and more sophisticated units using solid state choppers.

The small module types are relatively inexpensive and exhibit lower values of high frequency noise. The chopper stabilized differentials have excellent voltage and current offset and temperature drift in addition to very high input impedance.

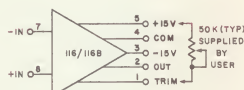
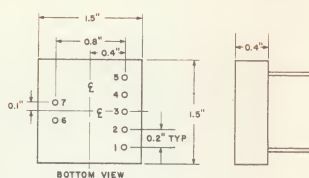
CHARACTERISTICS @ 25° C unless noted	1. SUPPLY VOLTAGE		2. QUIESCENT CURRENT		3. OUTPUT VOLTAGE		4. OUTPUT CURRENT		5. GAIN AT D.C.		6. INPUT IMPEDANCE (at D.C.) (Differential)		7. OFFSET VOLTAGE ADJUSTMENT		8. INPUT VOLTAGE DRIFT vs TEMP.		9. INPUT VOLTAGE DRIFT vs TIME (Constant Temp.) (WITHOUT TRIMS)		10. INPUT CURRENT DRIFT vs TEMP.		11. COMMON MODE VOLTAGE, MAX.		12. INPUT NOISE, NARROW BAND (2 cps to 50 cps)		13. INPUT NOISE, WIDE BAND (2 cps to 1 mc) (at unity gain)		14. GAIN BANDWIDTH PRODUCT FOR FULL OUTPUT			
	UNITS	± volts	ma	± volts	ma	v/v	meg	meg	—	μv/°C	μv/8 hr	na	na/°C	± volts	μv, pk	pk	mc	kc												
MODEL																														
115		15	4	10	4	50,000	0.2	20	EXT	50	50	500	5	10	10	25 μv	2	150												
115B		15	4	10	4	20,000	0.2	20	EXT	50	50	500	5	10	10	25 μv	2	10												
116		15	4	10	4	50,000	0.2	20	EXT	50	50	25	5	10	10	25 μv	2	150												
116B		15	4	10	4	20,000	0.2	20	EXT	50	50	150	5	10	10	25 μv	2	10												
131 (FET)		15	7	10	4	100,000	3,000	3,000	INT	20	50	1	0.1	7	15	50 μv	1	80												
111		24	15	20 / 10	4 / 20	10 ⁶	0.1	50,000	INT	5	15	0.1	0.05	200	15	0.5 mv	0.2	3												
112		125	20	100	20	10 ⁶	0.1	50,000	INT	5	15	0.1	0.05	200	15	0.5 mv	0.2	1												
113		75	25	50	50	10 ⁶	0.1	50,000	INT	5	15	0.1	0.05	200	15	0.5 mv	0.2	2												
111S		24	15	20 / 10	4 / 20	10 ⁶	0.1	50,000	INT	5	15	0.1	0.05	200	25	1 mv	0.14	3												
112S		125	20	100	20	10 ⁶	0.1	50,000	INT	5	15	0.1	0.05	200	25	1 mv	0.14	1												
113S		75	25	50	50	10 ⁶	0.1	50,000	INT	5	15	0.1	0.05	200	25	1 mv	0.14	2												

CASE SIZES (Dimensions in inches)



CASE STYLE E

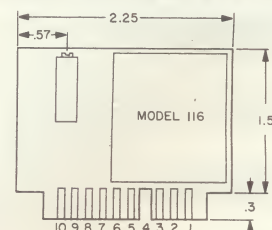
(Volume: 0.8 cu. in.,
weight: 0.8 oz.)



CASE STYLE F

(Volume: 0.9 cu. in.,
weight less than 1 oz.)

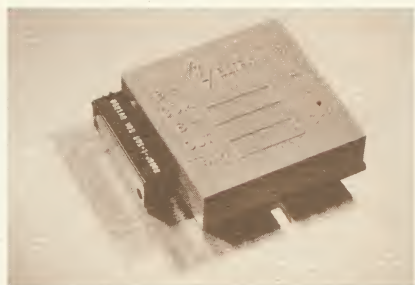
*Models 116-1 and 116B-1 with trim pot, add \$10 to price;
116-2 and 116B-2 without trim pot, add \$3 to price.



PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	NO CONN.	6	OUTPUT
2	+ IN	7	TRIM
3	- IN	8	+ 15
4	KEY	9	COMM
5	NO CONN	10	- 15

CASE STYLE G

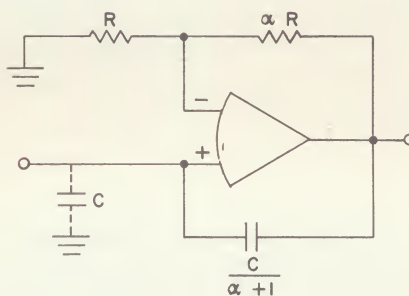
(Weight: 1 oz., mating connector
supplied: Viking VK10 S/1-2
or equivalent.)



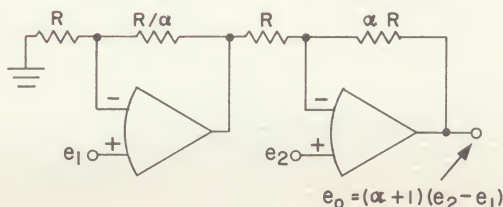
Model 116-1

applications

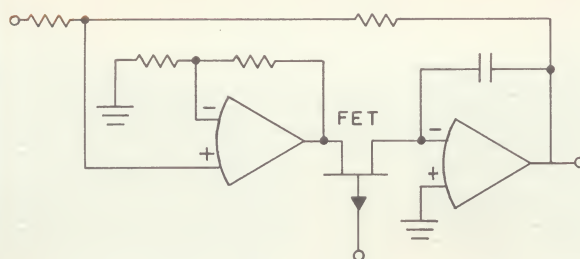
Differential operational amplifiers are extremely versatile devices. They can be used as conventional single ended units by grounding the $+$ input terminal or can be used differentially. The number of useful circuits that can be derived with a differential amplifier seems to be limited only by the inventiveness of the applications engineer. Many of the simple and more conventional circuits have been shown elsewhere. A few additional interesting circuits are shown below.



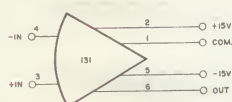
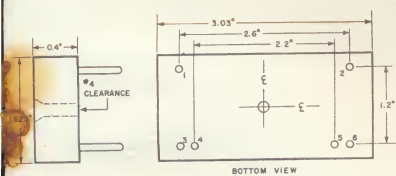
When connecting an amplifier for $+$ gain greater than one, it may be desirable to cancel the effects of stray capacity with positive feedback as shown.



This circuit provides a simple way to achieve differential amplification with two very high impedance input terminals. CMR can be optimized at DC by adjusting the resistor, R/α .

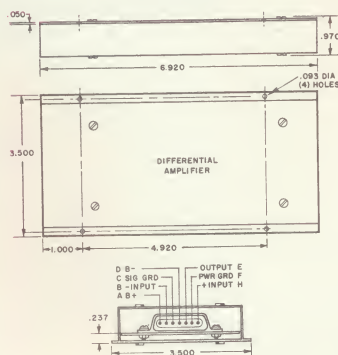


Track and hold circuit. Driver amplifier rapidly charges integrating capacitor through FET switch. Second amplifier can be FET Model 131 for minimum integrator drift during hold cycle.



CASE STYLE H

(Volume: 2.0 cu. in., weight: 1.6 oz.)



CASE STYLE J

(Weight: 11 oz., mating connector supplied: Winchester NAS714-7 or equivalent.)



Model 116

Cabinetry

The 120 series cabinets are designed to rack mount up to 15 amplifiers in a panel space of 5 1/4 by 19 inches. An internal supply is prewired to all connectors and provides all power required by the amplifiers. The hinged front panel supports the power switch and light, and the fuses and power cord are located at the cabinet rear. All cabinets are supplied with one Component Tray which plugs into the rear of the Cabinet and provides a convenient place to mount input and feedback components. The standoff solder terminals automatically connect to the amplifier signal leads when the tray is inserted into the cabinet, and external connection to the components and signal leads can be made in one of two ways; where direct connection is preferred, the feed through solder terminals shown are supplied on the rear panel of the Component Tray. Alternately, the Component Tray is provided with two 26 pin connectors on the rear panel at no extra charge.

Model 120-0 Cabinet. Without power supply. Connectors pre-wired for Differential Amplifiers, Models 111, 112, 113 and silicon counterparts. \$295.00

Model 120-0M1 Cabinet, less power for Models 141, 142 and 143.\$295.00

Model 120-1 Cabinet. With power supply and connectors for Models 111 and 111S.\$610.00

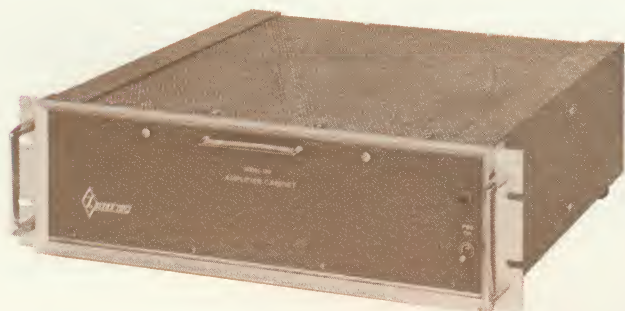
Model 120-2 Cabinet. With power supply and connectors for Models 112 and 112S.\$710.00

Model 120-3 Cabinet. With power supply and connectors for Models 113 and 113S.\$710.00

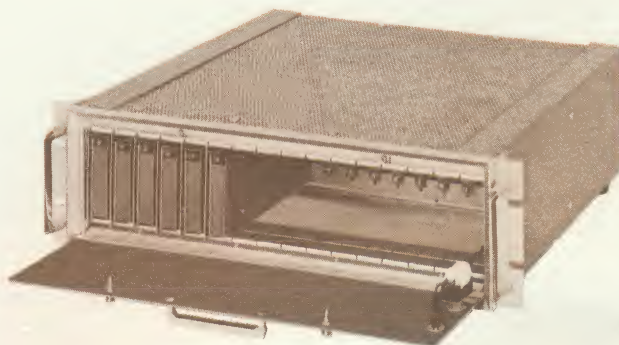
Model 120-4 Cabinet. With power supply and connectors for Model 141.\$610.00

Model 120-5 Cabinet. With power supply and connectors for Model 142.\$710.00

(Additional Component Trays @ \$70)



Front view, 120 Series cabinetry



Cabinet with front panel down

ORIES • 100 SERIES

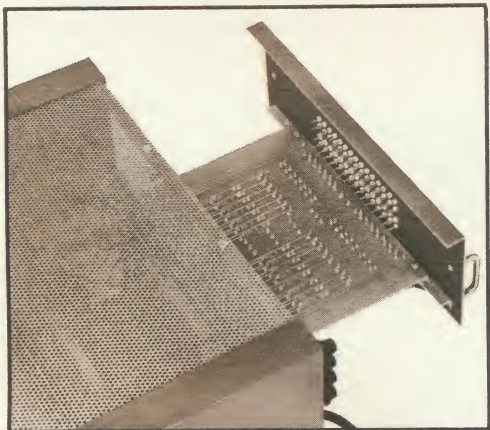
Power Supplies

- Model 100 Power Supply. ± 24 v @ 200 ma.
Dual regulation. 3 1/2 by 7 inches by
2 inches high. \$250.00
- Model 101 Power Supply. ± 125 v @ 250 ma.
Dual regulation. 5 1/4 by 9 1/2 inches by
4 1/4 inches high. \$350.00
- Model 102 Power Supply. ± 75 v @ 400 ma
dual regulated. 5 1/4 by 9 1/2 inches by
4 1/4 inches high. \$350.00
- Model 103 Power Supply. 24 v @ 600 ma
dual regulated. 5 1/4 by 9 1/2 inches by
4 1/4 inches high. \$350.00
- Model 1008 Power Supply. ± 24 v @ 30 ma. . . \$ 80.00
- Model 1008M1 Power Supply. ± 15 v @ 30 ma. . \$ 80.00

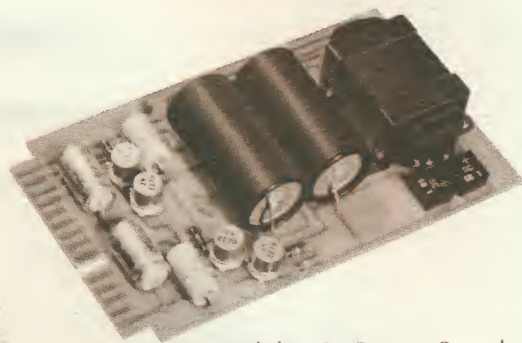
Miscellaneous

Model 120A Extender Card is an etched circuit card with connectors at both ends that slides into the 120 series Cabinetry and supports the amplifier outside the cabinet to permit servicing. The Model 120A uses 9 pin Winchester connectors and is for the Models 111, 112, 113 and silicon versions of the Differential Amplifiers. \$30.00

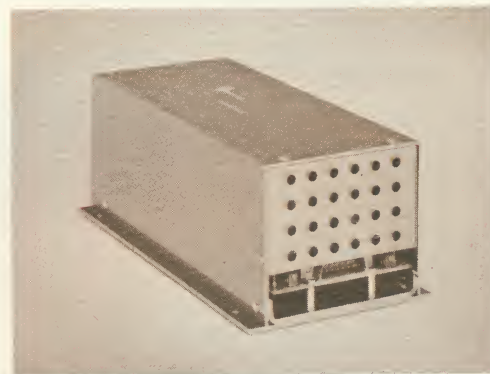
Model 120C Extender Card is similar to the Model 120A except that it uses 15 pin connectors. For amplifier Models 140, 141 and 142. \$30.00



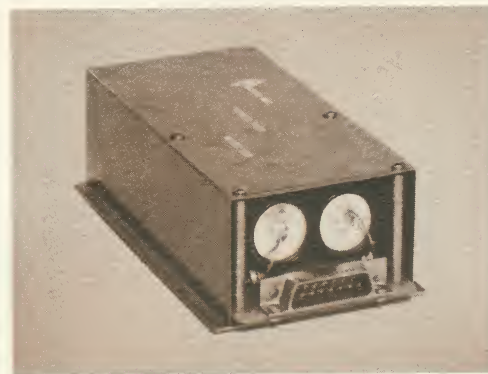
Component tray slides
into rear of cabinet



Model 1008 Power Supply
(Identical to Model 1008-M1)



Model 101 Power Supply
(Identical in size to Models 102 and 103)



Model 100 Power Supply

ZELTEX Representatives

The Zeltex Representative organization includes offices throughout the United States, Canada and overseas. These men have been carefully selected for their engineering skill and product knowledge so that they can truly be of service to you. Why not call your nearest Zeltex Representative and discuss your particular applications problem?



1. J & J ASSOCIATES

Waltham, Massachusetts
241 Crescent Street
Phone: (617) 899-0160
New Haven, Connecticut
32 Elm Street
Phone: (203) 624-7800

2. DOOLITTLE ELECTRONICS CORP.

Fayetteville, New York, 13066
P. O. Box 97
Phone: (315) 637-3222
Rochester, New York, 14623
516 Hollybrook Road
Phone: (716) 271-2800

3. HARVEY J. KRASNER ASSOCIATES

Great Neck, New York, 11021
33 Great Neck Road
Phone: (516) 487-0690

4. DENCO

Philadelphia, Pennsylvania
P. O. Box 11599
Phone: (215) OR 6-2525

5. TIBY CO.

Cleveland, Ohio
2245 Warrensville Center Rd.
Phone: (216) 371-5335
Detroit, Michigan
8701 Fenkell Avenue
Phone: (313) 834-9211
Dayton, Ohio
1954 N. Main Street
Phone: (513) 277-3822

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7. TECHNICAL MARKETING, INC.

Winter Park, Florida
755 West Fairbanks Avenue
Phone: (305) 647-6223
Greensboro, North Carolina
2218 Briarlea Road
Phone: (919) 274-2570
Huntsville, Alabama
904 Bob Wallace Avenue
Phone: (205) 534-2487
Largo, Florida
P. O. Box 344
Phone: (813) 596-0503

8. CONTACT FACTORY

9. TEXAS AVIONICS COMPANY

Seabrook, Texas, 77586
1108 Meyer
Phone: (713) HA 4-3155
Dallas, Texas, 75206
4515 Prentice Street
Phone: (214) 363-6324

10. AZTEC ENTERPRISES, INC.

Albuquerque, New Mexico
5206B Constitution, N.E.
Phone: (505) 268-6421
Englewood, Colorado, 80110
3385 South Bannock
Phone: (303) 761-0101

11. AW ELECTRONICS

Seattle, Washington
74 S. Lucille Street
Phone: (206) 725-7664

12. WIELER & COMPANY

Downey, California
10842 So. Paramount Blvd.
Phone: (213) 773-5982
(213) 861-9223
Los Altos, California
One First Street
Phone: (415) 948-7472
Arizona
Enterprise 365

13. ELECTRONETIC SYSTEMS, LTD.

Downsview, Ontario
62 Alness Street
Phone: (416) 636-3673
Montreal 26, Quebec
6420 Victoria Ave., Suite 17
Phone: (514) 737-2744

14. CONTROLS AND INSTRUMENTS

New York, New York 10016
15 E. 40th Street
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15. NEOTRONIC INSTRUMENTS

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62 Queensberry Street



ZELTEX, INC.

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Concord, California
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